SECTION 7

INSULATION AND SHEET METAL LININGS

7.1 REFERENCES

(7A) UNITED STATES PUBLIC HEALTH SERVICE (USPHS), *Handbook on Sanitation of Vessel Construction*

(7B) CENTER FOR DISEASE CONTROL (CDC) - *Recommended Shipbuilding Construction Guidelines for Cruise Vessels To Call on U.S. Ports*

(7C) WORLD HEALTH ORGANIZATION, *Guide to Ship Sanitation*

(7D) NAVIGATION AND VESSEL INSPECTION CIRCULAR (NVIC) 9-97, *Guide to Structural Fire Protection*

7.2 INTRODUCTION

This Section contains the Contractor Design and Provide general requirements for various insulation and sheet metal linings on the Vessel. See Section 25 of the Technical Specification for decorative linings and ceilings requirements.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

7.3 GENERAL

Due to potential future safety/regulatory concerns, **all insulation shall be of a faced type** so as to minimize the release of any type of fibers. All cut and exposed edges shall be taped, sealed, and a suitable sealer applied.

At intersections defining the boundary extent of the insulation, the insulation shall be extended or wrapped at least twelve (12) inches.

All insulation, linings and ceiling materials shall be non-combustible. Installation shall comply with the rat proofing requirements of References (7A), (7B), and (7C).

In designing the insulation systems, the effect of structural fire protection shall be considered in the acoustical treatment. Both structural and acoustical insulation may be considered as contributing to the thermal insulation for heat transmission.

Insulation shall not be packed in or compressed during installation.

All insulation shall be in direct contact with the surface that is being insulated (plates, beams, stiffeners, etc.) to eliminate voids between the structure and the insulation.

In way of bolted access plates, insulation and sheathing shall be installed in such a manner as to permit the removal of the bolted access plate without the necessity of totally removing or seriously damaging the insulation and sheathing. The outline of the bolted access plate shall be stenciled on the sheathing or insulation in a visible contrasting color.

Installation of all insulation, linings, and ceilings shall be determined by the Contractor's design.

Insulation of vent ducts shall be in accordance with Section 12 of the Technical Specification. Insulation and lagging of piping, equipment, and machinery shall be in accordance with Section 75 of the Technical Specification.

Decorative finishes and linings in Passenger spaces shall be applied as specified in Section 25 of the Technical Specification. In other spaces, all exposed surfaces shall be coated in accordance with Section 14 of the Technical Specification. Acoustic insulation behind perforated linings shall not be painted.

Bulkhead linings and ceilings shall be provided with hinged or removable flush panels with quick acting latches, as required, to provide access to valves, fire dampers, filters, electrical distribution boxes, or other equipment mounted behind the linings which require routine access. Ventilation system balance dampers shall be identified with labels only, as described in Section 24 of the Technical Specification.

Surfaces to which insulation is to be applied shall be painted or preserved in accordance with Section 14 of the Technical Specification. Surface preparation and painting shall be inspected and approved by the WSF Representative prior to the installation of any insulation.

Insulation shall be installed with weld pin hangers spaced on twelve (12) inch centers for bulkhead insulation and nine (9) inch centers for overhead installation with staggered centers and be a maximum of three (3) inches from the edges of the insulation. On the underside of the Lower Vehicle Deck, attach with 10 gage steel weld pins, secured with 2½ inch square galvanized self locking washers, clipped back and finished with a "WHITE" dome-cap. On all other areas, attach with 10 gage steel weld pins, secured with 1¼ inch diameter minimum galvanized self locking washers, clipped back and finished with a "WHITE" dome-cap, which are to be brought even with the insulation surfaces without depressing or cutting the insulation. Navy acoustic board insulation may be installed using studs and buttons. All insulation pieces shall be held in place by a minimum of two (2) pins or studs. **The use of adhesive backed retaining pins or studs <u>is</u> <u>prohibited</u>**.

To prevent water wicking up from the deck in wet spaces or in spaces where condensation may accumulate on the bulkhead, provide insulation cut back two (2) inches from the bottom

edge. A #16 USSG, minimum, galvanized steel bounding angle shall be tack welded and sealed to the bulkhead to support the insulation and provide an edge to tightly and neatly seal the insulation with fiberglass tape. Spaces selected for this treatment must be submitted and approved by the WSF Representative prior to commencement of installation.

Door insulation is covered under Section 4 of the Technical Specification. Fire screen doors shall be depicted as determined by the Contractor's design.

In areas where "B-15" Class rated joiner panels cover fire protection insulation, the Contractor may propose, in writing, to WSF and the USCG minimized fire protection insulation thickness based upon a two component system (fire protection plus "B-15" Class panels). The Contractor should be aware that special construction techniques must be used in order to meet the fire rating of the space.

7.4 STRUCTURAL FIRE PROTECTION

NOTE: The Contractor is advised that he is responsible for ensuring compliance with all currently applicable structural fire protection requirements, whether local, State, or Federal.

Design and provide structural fire protection throughout the Vessel in accordance with 46 CFR §72.05 and Reference (7D). All Surfaces inside the machinery casings, such as in miscellaneous lockers, storage, spares, and the like, shall default to A-60 Class divisions unless they are A-0 Class divisions. Thus, there shall be no decks, bulkheads, or parts thereof with a rating different from "A-0" or "A-60" Class inside the machinery case.

All material used in providing structural fire protection shall be currently certified by the USCG for the use intended and shall be 100-percent (100%) free of Asbestos Containing Material (ACM). Documented proof of the certification shall be required prior to the start of installation.

Structural fire protection underlayment shall be used to meet insulation requirements for the deck of the Passenger Deck in accordance with Section 6 of the Technical Specification.

Stairways requiring structural fire protection insulation shall be insulated from underneath using mineral wool batts or blankets as specified herein.

Structural insulation approved under 46 CFR §164.007 must be applied to piping, wiring and ductwork penetrating "A-Class" boundaries along the penetrating item for at least twelve (12) inches on the insulated side of the structure being penetrated. The thickness of

insulation used shall be the same as the division penetrated. Attachment shall be by means of 18 gage stainless steel wire wraps.

The Contractor shall design and provide all ceiling **draft stops** as required by 46 CFR §72.05-10.

Unless otherwise noted, mineral wool batts or blankets, whether sheathed or not, shall be faced with fiberglass cloth attached to the mineral wool using an approved adhesive such as BENJAMIN FOSTER #30-36, or equal. All seams shall be sealed with fiberglass cloth strips and the surface of the cloth coated with ECO-PERM Coating 11-02, or equal. Bulkheads, decks and stiffeners specified to have faced insulation shall be coated in accordance with **TABLE 14-1** of the Technical Specification. ECO-PERM products are available from MON-ECO INDUSTRIES, Inc. East-Brunswick, N.J.

Mineral wool batts or blankets shall be installed tight to the surface being protected and shall be contoured around angles and tees to ensure that there is no reduction in cross section and a minimal loss of contact with the structure.

Structural fire protection shall be installed with twelve (12) inch returns at the intersection with non-fire-screen boundaries. Where deck penetrations are made through underlayment or other materials which form an integral part of the structural fire protection, the penetrating member must be insulated for a distance of at least twelve (12) inches in accordance with NVIC 9-97. Electrical cable penetrations through fire rated boundaries shall be provided with a return stop on the insulated side of the boundary as set forth in Section 87 of the Technical Specification.

The effect of structural fire protection insulation may be considered in the design of acoustical and thermal treatments but acoustical protection and insulation shall not be considered in the design of structural fire protection insulation.

Required structural fire protection insulation may contribute to the acoustic insulation requirements. Acoustic insulation **will not** contribute to structural fire protection insulation requirements.

7.5 THERMAL INSULATION

Thermal insulation shall be applied on the boundary surfaces of **all** spaces that are heated or cooled as required in Section 12 of the Technical Specification, and which are exposed to the weather or are adjacent to or below unheated spaces, except in way of the Stacks. All spaces having common boundaries with a Fan Room below the Pilothouse, or the Vehicle Deck shall have that common boundary considered as exposed to weather and be insulated.

Insulation shall in general cover the inside surface of the bulkhead and overhead plating, wrap all beams and stiffeners, and shall extend at least twelve (12) inches beyond the exposed area around webs and flanges of beams, stiffeners, girders and other contiguous structure.

Thermal insulation installed on bulkheads and overheads shall be at least three (3) inches thick.

Thermal insulation shall have a K-factor of 0.23 at 75F degrees.

Beam wraps shall be one (1) inch thick and shall have nominal density of no less than three (3) pounds per cubic foot.

All material used in providing thermal insulation shall be currently certified by the U.S. Coast Guard (USCG) for the intended use and shall be 100-percent (100%) free of asbestos. Documented proof of the certification shall be required prior to the start of installation. (See Section 100 of the Technical Specification requirements regarding purchase technical specifications).

All edges and joints shall be sealed with tape of a type recommended by the insulation manufacturer to present a smooth, continuously sealed surface.

Insulation installed on bulkheads shall be cut back two (2) inch from the bottom at the deck bonding flat bar bulkhead intersection to prevent possible wicking. The edges of the insulation shall be tightly and neatly sealed with tape of a type recommended by the insulation manufacturer.

The crew quarters/accommodation block area/passageway decks shall be provided with thermal insulation to suit the Contractor's Design and the requirements of Section 12 of the Technical Specification.

See the *ACOUSTICAL INSULATION* Subsection in Section 12 of the Technical Specification.

7.6 ACOUSTICAL INSULATION

The following treatments shall be provided as a minimum, with the acoustic characteristics of the treatments upgraded as necessary to attenuate noise within the limits prescribed in Section 102 of the Technical Specification for each space.

All material used in providing thermal insulation shall be currently certified by the U.S. Coast Guard (USCG) for the intended use and shall be 100-percent (100%) free of asbestos. Documented proof of the certification shall be required prior to the start of installation. (See Section 100 of the Technical Specification requirements regarding purchase technical specifications).

All edges and joints shall be sealed with tape of a type recommended by the insulation manufacturer to present a smooth, continuously sealed surface.

Required structural fire protection insulation **may** contribute to the acoustic insulation requirements. Acoustic insulation **will not** contribute to required structural fire protection insulation requirements.

See the *ACOUSTICAL INSULATION* Subsection in Section 12 of the Technical Specification.

7.6.1 Passenger Elevator Trunk

Any overhead or bulkhead not covered with structural fire protection insulation shall be covered with at least two (2) inches of perforated hard-faced NC3AP Navy acoustic board.

The structural fire protection insulation in way of these trunks shall have a one pound per square foot density lead acoustic sheet sandwiched in the middle of the insulation.

7.6.2 Emergency Generator Room

Acoustical insulation, with a one (1) pound per square foot (psf) density lead acoustic sheet sandwiched midway between the A-60 layer of mineral wool, shall be provided in the Emergency Diesel Generator Room to dampen the noise levels on the Sun Deck (Officer and Crew Staterooms) when the generator is in operation as set forth in Section 102 of the Technical Specification.

7.6.3 Ship's Service Diesel Generator No. 3 Acoustic Enclosure

Design and provide a walk-in acoustic enclosure for the SSDG No. 3 in Engine Room No. 2. The enclosure shall include an acoustic bulkheads, overhead, deck treatment, acoustic access vision panel door, ventilation, and fire suppression.

The enclosure shall be designed and fabricated using NORAC CSG 600/70 (53dB reduction) panel system, or equal, and shall provide a sound reduction between the inside of the enclosure and the Engine Room of 50 dB or greater when the SSDG is running. The design of the enclosure system shall allow for access around the installed SSDG for maintenance and local repairs, and for removal of panels for major generator set repairs.

Ventilation shall include sound dampening.

Fire extinguishing shall meet Section 13 of the Technical Specification and Authoritative Agency requirements.

7.6.4 Engine Rooms Boundaries with Vehicle Deck

Acoustical insulation, with a one (1) pound per square foot (psf) density lead acoustic sheet sandwiched midway between the "A-60" layer of mineral wool of types and thicknesses suitable for meeting the dB(A) maximum sound pressure level criterion specified in Section 102 of the Technical Specification, shall be provided in the Engine Rooms to dampen the noise levels in the Vehicle Deck.

7.6.5 Engineering Operating Space (EOS)

The EOS boundaries, and their openings, shall be fitted with acoustic treatments incorporating high transmission loss materials, of types and thicknesses suitable for meeting the 70 dB(A) maximum sound pressure level criterion specified in Section 102 of the Technical Specification.

The EOS acoustic treatments shall be as follows, except that the transmission loss characteristics of the treatments shall be upgraded and additional noise attenuating features added as necessary to limit the interior sound pressure level to 70 dB(A) or less:

A. Interior bulkhead boundaries shall be lined with resiliently mounted acoustic panels with a galvanized protective sheet on the interior face. The acoustic panels shall have an airborne sound insulation index (Ia) of no less than 42 dB.

B. Interior overhead boundaries plate and structure shall be lined with resiliently mounted acoustic panels. The acoustic panels shall have an airborne sound insulation index (Ia) of no less than 42 dB.

C. All bulkheads and deck surfaces exposed to Engine Rooms shall be insulated on the Engine Room sides with a one pound per square foot density lead acoustic sheet sandwiched midway between the "A-60" layer of mineral wool and covered with perforated galvanized sheet metal.

D. A "floating floor" treatment, isolated from the EOS's steel boundary bulkheads, overhead, foundations, sub-bases and other sources of noise transmission by an approved elastic sealer and foam rubber sealing band shall be installed as set forth in Section 6 of the Technical Specification. The floating floor shall, at a minimum, incorporate a steel plate upper surface of ⅛ inch minimum thickness, with mineral wool treatment underneath. See the *ENGINEER'S OPERATING STATION (EOS) AREAS ACOUSTIC DECKS* Subsection in Section 6 of the Technical Specification.

E. The EOS deck areas within all foundations and any other areas, where not covered by the "floating floor" system, shall be acoustically insulated in a method equal to the "floating floor" system.

F. EOS doors shall have an airborne sound insulation index (Ia) of no less than 38 dB and be fitted with neoprene gaskets at head, jambs and sill. Refer to Section 4 of the Technical Specification for general requirements applicable to these doors.

F. The EOS supply and exhaust ventilation ducts and fans shall be configured as required by Section 64 of the Technical Specification and, as necessary, fitted with acoustic insulation conforming to the requirements of Section 12 of the Technical Specification.

The "floating" floor shall be laid over a smooth steel deck that has been cleaned, primer coated, and faired with underlayment. The floating floor shall be covered in accordance with Section 6 of the Technical Specification.

All boundaries and penetrations of the EOS shall be minimized and grouped. All openings around beams, stiffeners, pipes, cables and ducts passing through the boundaries of the EOS shall be filled with additional acoustical insulation or sealant. Sealant shall be applied to prevent sound leaks through panel seams, fastener holes and other miscellaneous small openings.

Particular attention shall be paid to providing an installation that minimizes sound paths between the Engine Room(s) and the interior of the EOS. It is essential that all panel connections to structural steel be isolated to minimize structure-borne noise transmission.

Alternate treatments will be given consideration by WSF provided that the alternative treatments are shown to have equal or better noise transmission loss characteristics than the treatments described herein.

Refer to Section 50 of the Technical Specification for additional EOS requirements.

7.6.6 Food Vending Area Bulkheads

Acoustical insulation, with a one (1) pound per square foot (psf) density lead acoustic sheet sandwiched midway between the "A-60" layer of mineral wool of types and thicknesses suitable for meeting the dB(A) maximum sound pressure level criterion specified in Section 102 of the Technical Specification, shall be provided in the Food Vending areas to dampen the noise levels to the Passenger cabin areas. The "Food Vending areas", for this Subsection, is defined as the Cafeteria and Small Galley areas on End No. 2 of the Passenger Deck.

7.6.7 Steering Gear Room Overheads

Acoustical insulation, with a one (1) pound per square foot (psf) density lead acoustic sheet sandwiched midway between the "A-60" layer of mineral wool of types and thicknesses suitable for meeting the dB(A) maximum sound pressure level criterion specified in Section 102 of the Technical Specification, shall be provided in the two (2) Steering Gear Room overheads to dampen the noise levels on the Lower Vehicle Deck.

7.6.8 Reduction Gear Room Overheads

Acoustical insulation, with a one (1) pound per square foot (psf) density lead acoustic sheet sandwiched midway between the "A-60" layer of mineral wool of types and thicknesses suitable for meeting the dB(A) maximum sound pressure level criterion specified in Section 102 of the Technical Specification, shall be provided in the two (2) Reduction Gear Room overheads to dampen the noise levels on the Lower Vehicle Deck.

7.6.9 Exhaust Trunk/Uptake Boundaries with Vehicle Space and Passenger Space

Acoustical insulation, with a one (1) pound per square foot (psf) density lead acoustic sheet sandwiched midway between the "A-60" layer of mineral wool of types and thicknesses suitable for meeting the dB(A) maximum sound pressure level criterion specified in Section 102 of the Technical Specification, shall be provided in the trunks and uptakes to dampen the noise levels in the Vehicle Deck and Passenger spaces.

7.6.10 Fan Rooms

Fan rooms acoustic insulation systems shall consist of one pound per square foot density lead acoustic sheet sandwiched and laminated between two (2) one inch thick layers of acoustic insulation using an USCG approved high strength, fire resistant adhesive. The acoustic insulation layer adjacent to the steel surfaces shall be one (1) inch thick N-3A un-faced hull-board and the acoustic insulation facing the space shall be two (2) inches of perforated hard-faced NC3AP Navy acoustic board. All seams shall be sealed with fiberglass cloth strips and the surface of the cloth coated with ECO-PERM Coating 11-02, or equal. Attachment shall be as set forth in the *GENERAL* Subsection in this Section of the Technical Specification. The facing shall be coated in accordance with Section 14 of the Technical Specification.

7.6.11 Crew State Rooms, Accommodations, and Passageways

The Officer and Crew Staterooms, Accommodations, and Passageways on the Sun Deck shall have suitable acoustical insulation to dampen noise levels between each Stateroom and the adjacent Passageway.

7.7 PERSONNEL PROTECTION

The Contractor shall provide personnel protection padding in areas wherever structure and/or equipment presents unavoidable personnel "head knocker" occurrences as set forth in the *PERSONNEL PROTECTION* Subsection in Section 1B and Section 14 of the Technical Specification. The pads shall be provided in addition to any required insulation treatments.

7.8 SHEET METAL SHEATHING AND LININGS

Lining shall be provided over insulation in spaces where physical damage to insulation is likely to occur. These spaces include, but are not limited to, Engine Rooms, Machinery

Casing, Sun Deck Life Jacket Lockers, fidley, accesses, storerooms, lockers, service rooms, gear lockers, offices, and accommodation spaces.

Unless directed differently in the Technical Specification, sheet metal sheathing shall be attached to all surfaces required to be sheathed in general accordance with **TABLE 7-1**, Sheet Metal Lining Schedule.

Portable sections of sheathing shall be provided where required for accessibility in way of wiring, ducts, piping, air conditioning controls, filters at unit air conditioners, etc. They shall be hinge-fitted with quick acting catches where frequent access is necessary.

Galvanized sheet steel linings shall be at least #16 gauge. Stainless steel linings shall be at least #20 gauge. Perforated linings shall have 0.125 inch holes on staggered center, of the proper percent (%) opening for structural and acoustic concerns, and be painted prior to installation. The Contractor shall cover and protect perforated linings during construction to assure that the perforations are not plugged by paint and debris.

All edges of linings shall be neatly trimmed and de-burred. Seams shall be butted and covered with a smoothed and de-burred strip of the next heavier gauge metal.

Trim pieces and escutcheon plates of like material shall be provided around linings and penetrations. Fasteners for all linings shall be square head, Type 316 stainless steel.

TABLE 7-1

Sheet Metal Lining Schedule

Space	Location	Type
Engine Rooms	Insulated bulkheads	Galvanized steel to at least six (6) feet above floorplate/grating level where floorplate, grating or working area is adjacent to insulation
Storage/Storerooms	Insulated bulkheads	Galvanized steel to at least six (6) feet above deck where floorplate, grating or working area is adjacent to insulation
Stairways, passageways and vestibules not covered by decorative lining	Lower Vehicle to Passenger Deck - Insulated bulkheads and deck overheads	Completely cover with galvanized steel

TABLE 7-1, cont'd
Sheet Metal Lining Schedule

Space	Location	Type
All other storerooms and workshops, machinery spaces, lockers, cleaning gear lockers, electrical distribution rooms, uptakes, Crew Stairwell, Crew Shelter, locker rooms, Emergency Squad Lockers and other rooms/spaces not exposed to public	Insulated bulkheads	Galvanized steel to at least six (6) feet above deck or flat where floorplate, grating or working area is adjacent to insulation
Workshop to include any passage from Workshop to surrounding spaces, Fuel Equipment Locker, Line Stowage Locker (LVD).	Insulated bulkheads	Galvanized steel from deck to overhead
Insulation in spaces accessible by Passengers and not covered by decorative lining	Throughout Vessel bulkhead and overheads	Galvanized steel

7.9 SPARE PARTS AND INSTRUCTION MANUALS

Provide a list of recommended spare parts and special tools for those items which are Contractor furnished, together with parts lists and instruction manuals necessary to maintain and service provided acoustic components and accessories in accordance with the requirements of Sections 86 and 100 of the Technical Specification.

7.10 TESTS, TRIALS, AND INSPECTIONS

Tests and/or trials shall be in accordance with Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and in Sections 1 and 2 of the Technical Specification.

7.11 PHASE II TECHNICAL PROPOSAL REQUIREMENTS

The deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase II Technical Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification.

The Design Specifications that the Contractor develops shall call out or identify the specific material used and the extent to which each material is to be used.

7.12 PHASE III - DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS

The following deliverable, in addition to other deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase III Detail Design stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Schedule of Insulation and Linings

The ***Schedule of Insulation and Linings*** shall show the extent of each type of insulation and typical installation details. This information may be keyed to the schedule of insulation and linings with regard to type, thickness, manufacturer, rating and USCG, or other Authoritative Agency approval numbers, or if all such data are clearly indicated on the drawing, the separate schedule may be omitted.

The ***Schedule of Insulation and Linings*** may be omitted if **all** information is presented on the *PHASE III Detail Design* insulation and linings drawings (#9001-007-01 and 02) in Section 100 of the Technical Specification.

(END OF SECTION)